VCE Unit 2 **ENVIRONMENTAL CHEMISTRY** **CHEMISTRY**

Unit 2 of VCE Chemistry deals with The Atmosphere, Water, different Reaction Types and Green Chemistry:

Areas of Study:

1. Water: This area of study will cover: The special properties of Water useful to living things in relation to the relationship between structure and bonding; the uses of water in relation to Solubility and Conductivity; Reaction in water including Dissociation of soluble Ionic solutes and Ionisation of Polar molecules and Separation of non-Ionising molecules such as Ethanol; Types of Acids & Bases; Chemical reactions in Aqueous solutions including Precipitation, Acid-Base and Redox reactions; Writing Molecular and Ionic Equations and using them to calculate amounts of Reactants & Products using mass-mass Stoichiometry and Concentration and Volume of solutions; Solubility and pH when dealing with Pollution and maintaining the quality of water and outline processes using Green Chemistry such as replacement of halogenated solvents with supercritical CO_2.

2. The Atmosphere: This area of study will cover: The role of the Atmosphere in maintaining life including the effects of human activities such as agriculture, industry, transport, energy production; Chemical Reactions and Processes of Acid Rain; Qualitative Effects of Ozone depletion and Photochemical smog, the role of the Nitrogen and Carbon Cycles in maintaining life; the laboratory and industrial production of one gas significant to the atmosphere; the major gases contributing to the enhanced Greenhouse Effect and the Local, State or International Protocols; the Kinetic Molecular Theory in explaining the properties of Gases; Calculations involving the Gas Laws, Molar Volume at STP & SLC, the general Gas Equation, volume-volume and mass-volume Stoichiometry.

RESOURCES: Text, Lecture Notes, Rev. Sheets, Studywiz Mr Wallis Chem siteUltranet: search for Chemistry

To complete the unit, you must satisfactorily complete the Outcome explained below:

Outcome 1: Qualitative & Quantitative (inc Balanced Equations) Investigations of Reactions (10 - 15 hrs)

Choose ONE of: (If the extended investigation is done in Unit 1, then the alternate activity is done in Unit 2)

An extended experimental investigation: Either student designed or assigned by the teacher requiring between 3 and 5 hours of practical work. Students can work in pairs or small groups and should complete a Risk Assessment and Logbook as part of this task.

Experiments include: Reactions of HCl, Precipitation Reactions, Corrosion & Half Cell Reactions **OR**
Experiments include: Properties of Water, Solubility Curves, Concentrations in Solutions

OR *A summary report including annotations of THREE practical activities which can be student designed &/or teacher assigned requiring between 3 and 5 hours of practical work. The annotations illustrate the links between the practical activities (data, techniques, concepts, problems faced and recommendations for future activities).*

Outcome 2: How Chemical Reactions/Processes In the Atmosphere Help Sustain Life On Earth

Choose ONE of:

An analysis of a newspaper/magazine article on Reducing Greenhouse Gases in written or media format **OR**
An analysis of a newspaper/magazine article on Reducing Ozone Depletion in written or media format **OR**
A set of experiments based on the properties of Gases (Charles' & Boyle's Laws) **OR**
A written, oral, visual or multimedia presentation on the Nitrogen **or** Carbon Cycles

TEXTBOOK CHAPTERS TO BE STUDIED.

10. Water: Essential To Life.
11. Measuring Solubility.
12. Water: Removing Dissolved Solutes.
13. Introducing Acids & Bases.
14. Acids & Bases.
15. Calculations In Chemistry.
17. Green Chemistry.
18. The Atmosphere.
19. Environmental Issues.
20. Gases Of The Atmosphere.
21. Physical Properties of Gases.

16. Redox Chemistry & Corrosion.

VCE Unit 2 Chem **REACTION INVESTIGATION** **O-1**

Construct molecular models of the water molecule and a section of ice lattice.
Write equations for substances dissolving in water.
Draw a concept map of the ways different substances can dissolve in water.
Test electrical conductivities of solutions and explain the results in terms of structure and bonding.
Calculate solute concentrations in different units (%w/w, g/L, g/mL, M, ppm, etc).
Use solubility data to purify a compound by recrystallisation.
Write Full and Ionic equations for precipitation reactions.
Investigate common reactions involving acids and bases and write balanced equations.
Relate the strength and concentration of acids and bases to the safety precautions for their use.
Differentiate between a strong and concentrated acid or base.
Write balanced equations to demonstrate the hydrolysis of acids.
Investigate the pH of common household chemicals using colour changes in Universal indicator.
Perform simple Gravimetric or Volumetric analysis.
Identify corrosion as a redox reaction and methods of protecting the anode from oxidation.
Explain redox reactions in terms of electron transfer.
Complete exercises on identifying Oxidation and Reduction reactions.
Investigate the purification of domestic water supplies.
Review articles on environmental issues associated with water supplies.
Select one of the principles of Green Chemistry and report on the ways it is supported by local industries.
Investigate the chemicals used to protect crops (herbicides, fungicides) and compare with natural insecticides

DETAILED EXAMPLE: In a group, investigate the properties and use of Super critical Carbon Dioxide.

Person 1: Investigate the nature of supercritical Carbon Dioxide and use Phase diagrams to illustrate at a molecular level the transitions between states/phases of Carbon Dioxide:

Person 2: Investigate the processes/conditions required to produce super critical Carbon Dioxide.

Person 3: Investigate the industrial uses of super critical Carbon Dioxide. Identify the chemical replaced by super critical Carbon Dioxide and explain the benefits of using it. eg. decaffination of coffee beans, extraction of flavours from hops, use in the synthesis of polymers, in cleaning.

VCE Unit 2 Chem **CHEMICAL PROCESSES IN THE ATMOSPHERE** **O-2**

Investigate the effect of SO_2 on seedlings.
Describe the formation of Ozone in the atmosphere.
Prepare and test the properties of Carbon Dioxide or Oxygen.
Demonstrate the properties of Dry Ice or Liquid Nitrogen.
Discuss the limitations of Kinetic Molecular Theory.
Perform experiments demonstrating Charles' & Boyles' Laws.
Perform calculations using Charles' & Boyles' Laws and Avogadro's Constant and the Ideal General Gas equation.
Perform an experiment to calculate the Molar Volume at SLC or STP.
Perform calculations involving Partial Pressures.

DETAILED EXAMPLE: An Investigation into Carbon Dioxide

Part A: Formation of Carbon Dioxide by the action of acid on Metal Carbonate or Bicarbonates, Decomposing Metal Carbonates, by Respiration, by Fermentation and Combustion of Fossil fuels.

Part B: Properties & Uses of Carbon Dioxide: Determine the Molar Mass of Carbon Dioxide experimentally and Observe some of the properties of Carbon Dioxide such as its Density, Acidic Properties in solution, Fire Extinguishing properties and the reaction with Magnesium.

Part C: Solubility of Carbon Dioxide at different temperatures (in Soda drinks) by measuring the pH to determine the amount of dissolved H^+ due to the formation of H^+ and HCO_3^- ions.

VCE Unit 2 **ACIDS/BASES, THE ATMOSPHERE & CORROSION** **CHEMISTRY**

Unit 2 of VCE Chemistry deals with the Acids in the Environment, Gases in the Atmosphere and Corrosion:

3. Acids in the Environment: This area of study will cover: the importance of acids & bases in the environment; the properties of acids and bases; acid-base reactions (Acid with Metal Carbonates, Hydrogen Carbonate, Metal Oxide and Metal Hydroxide); Lowry Bronsted Acid/Base theory; Polyprotic and Monoprotic acids, Ionisation, Amphiprotic substances, Conjugate Acid/Base pairs and Strong/Weak acids and bases; pH measurement; the Mole concept; Relative Isotopic Mass, Relative Atomic Mass, Relative Molecular Mass, % composition, Molecular Formula, Empirical Formula, Concentration (mol/L) and simple Stoichiometry (m/m, m/c/V).
4. The Atmosphere: This area of study will cover: the constituents of the Atmosphere and their interaction with organisms including Photosynthesis, Respiration, Nitrogen Fixation, Combustion and Pollution, Commercial production, properties and uses of Nitrogen, Oxygen and Carbon Dioxide; Laboratory production and testing of Carbon Dioxide and Oxygen and their reactions; Noble gases and their position on the Periodic Table; Kinetic Molecular Theory and Diffusion of Gases; Boyle's Law, Charle's Law, General Gas equation, Partial Pressure (in mmHg, Pa, hectopascals, kPa and Bars), Volume (in L, dm^3 and m^3), Temperature (in ^oC and K); Molar Volume; STP and SLC as well as simple v/v and m/v Stoichiometry.
5. Corrosion: This area of study will cover: the Reactions of Metals in the atmosphere; e- transfer during Corrosion (Oxidation, Reduction, Oxidant and the Reductant in half equations); the Metal Activity Series; features of simple Galvanic Cells (Electrodes, Electrolyte, Salt bridge, Electrode Polarity, e- movement and Ion flow), use of Galvanic cells to predict Reactivity Series for Al, Zn, Mg, Cu, Fe, Pb, Sn and Cu, the relationship between reactivity and position on the Periodic Table, corrosion of Iron in the atmosphere and preventing corrosion (cathodic, painting and sacrificial anodes).

RESOURCES: Text, Lecture Notes, Rev. Sheets, Content Management:Unit 1 & 2:Science:Chemistry:Unit 2

To complete the unit, you must satisfactorily complete the 3 Outcomes explained below:

Outcome 1: **Writing Equations and Stoichiometry. DUE:**
This Outcome relates to Area of Study 1, 2 and 3. This outcome should enable you to write balanced molecular and Ionic equations and perform Stoichiometry. You will perform laboratory experiments to use indicators and pH meters to indicate the pH of acids and bases. You will design and perform experiments to determine the % composition or Empirical Formula of compounds or experiments that require simple Stoichiometry as well as experiments that rank metals in Reactivity order. The experiments will be provided on sheets with spaces for you to record observations, answer questions and write a conclusion.
You must submit **all the experiments** for assessment and keep a record of the experiments done in a logbook.
You will write balanced Molecular & Ionic equations and complete questions to determine the Empirical & Molecular Formulae of compounds, % composition of compounds, perform m/m and m/c/v Stoichiometry, pH calculations and identify the Acid and Base and the Oxidant and Reductant in different chemical equations.
You will also produce a concept map that shows the links associated within Redox reactions and Galvanic cells.

Outcome 2: **Production, Properties and Calculations of Gases. DUE:**
This Outcome relates to Area of Study 2. This outcome should enable you to prepare gases, determine their properties and perform calculations involving gases. You will perform experiments to explain the Kinetic Molecular Theory and to prepare and test the properties of gases. The experiments will be provided on sheets with spaces for you to record observations, answer questions and write a conclusion.
You must submit **all the experiments** for assessment and keep a record of the experiments done in a logbook.
You will complete questions to relate the Kinetic Molecular Theory of Gases to Temperature and to perform calculations and interpret graphical data involving Boyle's Law, Charle's Law and the General Gas equation.

Outcome 3: Chemical Processes in the Environment. DUE:
This Outcome relates to Area of Study 2 and 3. This outcome should enable you to understand the process of Corrosion and the different processes that occur in the Atmosphere.
You will design and perform experiments investigating the corrosion of Iron.
You must submit **all the experiments** for assessment and keep a record of the experiments done in a logbook.
You will write a report that demonstrates the connections between different Atmospheric processes.
You will explain how an element's position on the Periodic Table relates to its Oxidation-Reduction chemistry.

TOPICS TO BE STUDIED.

15. Introducing Acids.
16. Acids and Bases.
17. Quantities In Chemistry.
19. The Atmosphere: A Vital Resource.
20. Gases Of The Atmosphere.
21. Physical Properties of Gases.
23. Corrosion: A Cost To Society.
24. Corrosion: The Chemical Process.
26. Producing Chemicals In Society.
27. Local Chemical Industry.

VCE Unit 2 **CHEMISTRY IN EVERYDAY LIFE** **CHEMISTRY**

Unit 2 of VCE Chemistry deals with Chemistry in Everyday Life;
a). The Acid/Base Reactions - Focal Questions: What role do Acids and Bases play in our environment and what quantities are used to measure chemicals?
b). The Gases in the Atmosphere - Focal Question: How do we interact with the Atmosphere?
c). Corrosion of Metals - Focal Question: How do metals corrode and how is corrosion prevented?

The course duration is 100 hours with 60 hours devoted to class work
As students you will be expected to complete a set of work requirements which will determine whether you will satisfactorily complete the unit. These include :-

Work Requirement 1 :- **Investigation Of Chemical Reactions**. **(Part of 25 hours) DUE :**
This refers to laboratory experiments on Acid/Base reactions, the determination of Empirical Formula and simple Stoichiometric exercises. The experiment write-ups will be provided on master sheets with spaces for you to record observations, answer questions and note down your conclusion. You must submit **all the experiments and exercises** for assessment, **keep a record of the experiments done in a logbook**.
You will then need to **prepare a response** to the Focal Questions; What role do Acids and Bases play in our environment?

Work Requirement 2 :- **Investigation Of Gases**. **(Part of 25 hours) DUE :**
This refers to laboratory experiments on Gas Laws, the preparation, collection and testing of gases. The experiment write-ups will be provided on master sheets with spaces for you to record observations, answer questions and note down your conclusion. You will also be expected to answer questions dealing with balancing equations, Gas Laws and the Kinetic Theory of Gases. You must submit **all the experiments** for assessment, **keep a record of the experiments done in a logbook**.
You will then need to **prepare a response** to the Focal Question; How do we interact with the Atmosphere?

Work Requirement 3 :- **Investigation Of Oxidation/Reduction**. **(Part of 25 hours). DUE :**
This refers to laboratory experiments on the Oxidation and Reduction, simple Galvanic Cells and the order of metal reactivity. The experiment write-ups will be provided on master sheets with spaces for you to record observations, answer questions and note down your conclusion. **One experiment** should be designed by YOU. You must submit **all the experiments** for assessment, **keep a record of the experiments done in a logbook.**
You will then need to **prepare a response** to the Focal Question; How do metals corrode and how is corrosion prevented?

Work Requirement 4 :- **Exercises**. **DUE :**
This refers to questions that you will complete based upon Concentration, pH calculations, the mole concept, % composition, Emprirical Formula, Molecular Formula, balancing equations, simple Stoichiometry, Kinetic Theory of Gases, interpretation of 2nd hand data and simple Galvanic Cells.
You will also need to produce a **concept map** linking the theory of either Acids/Bases or Oxidation/Reduction.
You will then need to **prepare a response** to the Focal Question; What quantities are used to measure chemicals?

Work Requirement 5 :- **Investigation Of A Chemical Of Local Importance**. **DUE :**
This involves writing a 2000 word report after selecting a chemical of local importance and collecting information (a site visit or phone interview could be arranged) on the uses of the chemical over time, the raw materials and their sources used to produce the chemical, the chemistry involved in the production, the wastes generated in the production and the use of chemicals and methods to treat the wastes, the quality, health and environmental control, the occupational health and safety of people involved in the production and the range of careers involved in the production.
A glossary will need to be written outlining the meaning of any chemical terms used in the report.
A separate sheet will be given out explaining the information required in more detail.

Topic to be covered include :.
15. Introducing Acids.
16. Acids and Bases.
17. Quantities In Chemistry.
19. The Atmosphere; A Vital Resource.
20. Gases Of The Atmosphere.
21. Physical Properties of Gases.
23. Corrosion: A Cost To Society.
24. Corrosion: The Chemical Process.
26. Producing Chemicals For Society.
27. Local Chemical Industry.